AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claim 1 (Previously Presented): A method comprising:

displaying, via a user interface of a computing device, a three-dimensional (3D) digital representation of a tooth of a dental arch within a 3D environment; and

while displaying the digital representation of the tooth of the dental arch, displaying, via the user interface of the computing device, a two-dimensional planar guide within the 3D environment as a visual aid to a practitioner in a placement of an orthodontic appliance relative to the tooth of the dental arch within the 3D environment,

wherein the two-dimensional planar guide is displayed separately from the digital representation of the tooth, and

wherein displaying the planar guide comprises, as the practitioner moves the orthodontic appliance relative to the tooth within the 3D environment, rendering the planar guide at a location that is based on at least one of a position or an orientation of the orthodontic appliance within the 3D environment.

Claim 2 (Previously Presented): The method of claim 1, wherein displaying a planar guide comprises displaying the planar guide proximal to a surface of the digital representation of the tooth of the dental arch to aid the practitioner in the placement of the orthodontic appliance on the tooth.

Claim 3 (Original): The method of claim 2, wherein displaying a planar guide further comprises generating the planar guide within the 3D environment relative to a coordinate system associated with the orthodontic appliance.

Claim 4 (Previously Presented): A method comprising:

displaying, via a user interface of a computing device, a three-dimensional (3D) digital representation of a tooth of a dental arch within a 3D environment;

positioning an orthodontic appliance at a position within the 3D environment in response to input from a practitioner; and

while displaying the digital representation of the tooth of the dental arch, displaying, via the user interface of the computing device, a two-dimensional planar guide within the 3D environment as a visual aid to the practitioner in adjusting a placement of the orthodontic appliance relative to the tooth of the dental arch within the 3D environment, wherein the two-dimensional planar guide is displayed separately from the digital representation of the tooth, and

wherein displaying the planar guide comprises:

rendering the planar guide at a location within the 3D environment that is based on the position of the orthodontic appliance;

receiving input from the practitioner moving the placement of the orthodontic appliance with respect to the tooth within the 3D environment; and

automatically moving the planar guide within the 3D environment as the practitioner moves the orthodontic appliance with respect to the tooth within the 3D environment.

Claim 5 (Previously Presented): The method of claim 1, wherein the planar guide comprises a mesial planar guide, and displaying a planar guide further comprises rendering the mesial planar guide and a distal planar guide parallel to a midsagittal plane of the orthodontic appliance, wherein the orthodontic appliance defines a mesial edge, a distal edge, and a longitudinal axis and the midsagittal plane is substantially parallel to the longitudinal axis, and wherein the mesial planar guide aligns with the mesial edge of the orthodontic appliance and the distal planar guide aligns with the distal edge of the orthodontic appliance.

Claim 6 (Original): The method of claim 5, wherein rendering a mesial planar guide and a distal planar guide further comprises rendering the mesial planar guide and the distal planar guide parallel to and equidistant from the midsagittal plane of the orthodontic appliance.

Claim 7 (Previously Presented): The method of claim 1, wherein the planar guide comprises an occlusal planar guide, and displaying a planar guide further comprises rendering the occlusal planar guide parallel to a midlateral plane of the orthodontic appliance and proximate an occlusal surface of the tooth of the dental arch.

Claim 8 (Original): The method of claim 1, wherein the planar guide comprises a midlateral planar guide, and displaying a planar guide further comprises rendering the midlateral planar guide parallel to a midlateral plane of the orthodontic appliance.

Claim 9 (Original): The method of claim 1, wherein the planar guide comprises a midfrontal planar guide, and displaying a planar guide further comprises rendering the midfrontal planar guide parallel to a midfrontal plane of the orthodontic appliance.

Claim 10 (Previously Presented): The method of claim 1, wherein the planar guide comprises a midsagittal planar guide, and displaying a planar guide further comprises rendering the midsagittal planar guide parallel to a midsagittal plane of the orthodontic appliance, wherein the midsagittal plane is substantially parallel to a longitudinal axis of the orthodontic appliance.

Claim 11 (Previously Presented): The method of claim 1, wherein the planar guide comprises a gingival planar guide, and displaying a planar guide further comprises rendering the gingival planar guide parallel to a midlateral plane of the orthodontic appliance and proximate a gingival edge of the tooth of the dental arch.

Claim 12 (Original): The method of claim 1, wherein displaying a planar guide further comprises displaying the planar guide as a semi-transparent two-dimensional plane within the 3D environment.

Claim 13 (Original): The method of claim 1, wherein displaying a planar guide further comprises displaying the planar guide as a partial plane comprising at least two lines within the 3D environment.

Claim 14 (Previously Presented): The method of claim 1, further comprising:

displaying, via the user interface of the computing device, the planar guide as a first planar guide having a first color; and

displaying, via the user interface of the computing device, a second planar guide within the 3D environment with a second color different from the first color.

Claim 15 (Original): The method of claim 14, further comprising adjusting the first color and the second color in response to input from the practitioner.

Claim 16 (Original): The method of claim 1, further comprising adjusting a transparency of the planar guide based on input from the practitioner.

Claim 17 (Original): The method of claim 1, further comprising displaying the planar guide as opaque or invisible based on input from the practitioner.

Claim 18 (Previously Presented): The method of claim 1, further comprising:

storing data with the computing device, wherein the data describes attributes for types of orthodontic appliances that may be selected by the practitioner, and

controlling the display of the planar guide based on the stored attributes for the types of orthodontic appliances.

Claim 19 (Original): The method of claim 18, wherein storing attributes for types of orthodontic appliances comprises storing one or more of dimensions, slot locations, torque angles, and angulations for the types of orthodontic appliances.

Claim 20 (Previously Presented): The method of claim 1, further comprising:

storing planar guide data with the computing device, wherein the planar guide data specifies a plurality of types of planar guides;

receiving input from the practitioner enabling the display of at least one or more the types of planar guides; and

displaying the planar guide via the user interface in accordance with the selected one or more types of planar guides.

Claim 21 (Previously Presented): The method of claim 1, further comprising:

storing planar guide data with the computing device, wherein the planar guide data describes attributes for different types of planar guides, and

displaying the planar guide via the user interface in accordance with the stored attributes for the different types of planar guides.

Claim 22 (Original): The method of claim 21, wherein storing planar guide data comprises storing attributes for the different types of planar guides with respect to different types of orthodontic appliances.

Claim 23 (Original): The method of claim 21, wherein storing planar guide data comprises storing attributes for the different types of planar guides with respect to different types of teeth within the dental arch.

Claim 24 (Previously Presented): The method of claim 21, wherein storing planar guide data comprises storing attributes that specify distances for each of the different types of planar guides with respect to at least one of the tooth of the dental arch, a different one of the planar guides, and the orthodontic appliance.

Claim 25 (Original): The method of claim 21, wherein storing planar guide data comprises storing attributes that specify shear angles and scales for the different types of planar guides.

Claim 26 (Previously Presented): The method of claim 1, further comprising automatically scaling the planar guide within the 3D environment to size the planar guide based on one or more dimensions of the tooth of the dental arch.

Claim 27 (Original): The method of claim 1, further comprising automatically shearing the planar guide in accordance with a shear factor that is based on an angulation associated with the orthodontic appliance.

Claim 28 (Previously Presented): The method of claim 27, wherein the orthodontic appliance defines a mesial edge and a distal edge, and wherein automatically shearing the planar guide comprises automatically shearing the planar guide to align the planar guide with at least one of the mesial edge or the distal edge of the orthodontic appliance.

Claim 29 (Previously Presented): The method of claim 1, further comprising:

storing data with the computing device, wherein the data defines one or more placement rules for placing the orthodontic appliance; and

controlling the planar guide to assist the practitioner in positioning the orthodontic appliance in accordance with the placement rules.

Claim 30 (Previously Presented): The method of claim 29, further comprising automatically rendering the planar guide within the 3D environment as parallel to a midsagittal plane of the orthodontic appliance in response to one of the placement rules that requires a longitudinal or occlusal-gingival axis of the orthodontic appliance be aligned with a midsagittal plane of the tooth, wherein the midsagittal plane of the orthodontic appliance is substantially parallel to the longitudinal axis of the orthodontic appliance.

Claim 31 (Previously Presented): The method of claim 1, further comprising:

storing, with the computing device, statistical normal distances for one or more dimensions of teeth; and

rendering the planar guide at the location within the 3D environment based on the statistical normal distances.

Claim 32 (Previously Presented): The method of claim 31, further comprising:

receiving input biasing the planar guide relative to the statistical normal distance; and

adjusting the location for the planar guide within the 3D environment based on the input.

Claim 33 (Previously Presented): The method of claim 1, further comprising displaying, via the user interface of the computing device, visual reference markers relative to the planar guide at discrete intervals.

Claim 34 (Original): The method of claim 33, wherein displaying visual reference markers comprises displaying a rectilinear grid of semi-transparent lines on the planar guide.

Claim 35 (Original): The method of claim 33, wherein displaying visual reference markers comprises displaying points, crosshairs, tic marks, discs, squares, or spheres at the discrete intervals.

Claim 36 (Original): The method of claim 33, wherein displaying visual reference markers comprises displaying the visual reference markers throughout a volume bounded by the planar guide and at least one other planar guide.

Claim 37 (Previously Presented): The method of claim 1, further comprising displaying, via the user interface of the computing device, contour lines on the planar guide, wherein each contour line indicates a constant distance to a surface of the tooth within the 3D environment relative to the planar guide.

Claim 38 (Original): The method of claim 1, wherein the orthodontic appliance comprises an orthodontic bracket, a buccal tube, a sheath, a button or an arch wire.

Claim 39 (Previously Presented): A system comprising:

a computing device; and

modeling software executing on the computing device, wherein the modeling software comprises:

a rendering engine that renders a three-dimensional (3D) digital representation of a tooth of a dental arch within a 3D environment, and

a user interface that displays the digital representation of the tooth of the dental arch while displaying a two-dimensional planar guide within the 3D environment as a visual aid to a practitioner in a placement of an orthodontic appliance relative to the dental arch within the 3D environment, wherein the planar guide is displayed separately from the digital representation of the tooth, and wherein, as the practitioner moves the orthodontic appliance relative to the tooth within the 3D environment, the rendering engine renders the planar guide at a location based on at least one of a position or an orientation of the orthodontic appliance within the 3D environment.

Claim 40 (Previously Presented): The system of claim 39, wherein the modeling software comprises a guide control module that controls the location of the planar guide within the 3D environment.

Claim 41 (Previously Presented): The system of claim 40, wherein the guide control module locates the planar guide proximal to a surface of the digital representation of the tooth of the dental arch within the 3D environment to aid the practitioner in adjusting the placement of the orthodontic appliance on the tooth.

Claim 42 (Original): The system of claim 40, wherein the guide control module generates the planar guide within the 3D environment based on a coordinate system associated with the orthodontic appliance.

Claim 43 (Previously Presented): The system of claim 40, wherein the guide control module receives input from the practitioner via the user interface, the input comprising an adjustment to the placement of the orthodontic appliance with respect to the tooth within the 3D environment, and automatically moves the planar guide within the 3D environment as the practitioner moves the orthodontic appliance with respect to the tooth within the 3D environment.

Claim 44 (Previously Presented): The system of claim 40, wherein the planar guide comprises a mesial planar guide, and the guide control module generates the mesial planar guide and a distal planar guide parallel to a midsagittal plane of the orthodontic appliance, wherein the orthodontic appliance defines a mesial edge, a distal edge, and the midsagittal plane is substantially parallel to a longitudinal axis of the orthodontic appliance and aligns with the mesial edge of the orthodontic appliance and the distal planar guide aligns with the distal edge of the orthodontic appliance.

Claim 45 (Original): The system of claim 44, wherein the guide control module generates the mesial planar guide and the distal planar guide parallel to and equidistant from the midsagittal plane of the orthodontic appliance.

Claim 46 (Original): The system of claim 40, wherein the planar guide comprises an occlusal planar guide, and the guide control module locates the occlusal planar guide within the 3D environment parallel to a midlateral plane of the orthodontic appliance and proximate an occlusal surface of the tooth.

Claim 47 (Original): The system of claim 40, wherein the planar guide comprises a midlateral planar guide, and the guide control module locates the midlateral planar guide parallel to a midlateral plane of the appliance.

Claim 48 (Original): The system of claim 40, wherein the planar guide comprises a midfrontal planar guide, and the guide control module generates the midfrontal planar guide parallel to a midfrontal plane of the orthodontic appliance within the 3D environment.

Claim 49 (Previously Presented): The system of claim 40, wherein the planar guide comprises a midsagittal planar guide, and the guide control module generates the midsagittal planar guide parallel to a midsagittal plane of the orthodontic appliance, wherein the midsagittal plane is substantially parallel to a longitudinal axis of the orthodontic axis.

Claim 50 (Original): The system of claim 40, wherein the planar guide comprises a gingival planar guide, and displaying a planar guide further comprises rendering the gingival planar guide parallel to a midlateral plane of the orthodontic appliance and proximate a gingival edge of the tooth.

Claim 51 (Original): The system of claim 39, wherein the user interface displays the planar guide as a semi-transparent two-dimensional plane within the 3D environment.

Claim 52 (Original): The system of claim 39, wherein the user interface displays the planar guide as a partial plane comprising at least two lines.

Claim 53 (Original): The system of claim 40, further comprising:

a database to store data that describes attributes for types of orthodontic appliances that may be selected by the practitioner, and

wherein the guide control module controls the location of the planar guide based on the stored attributes.

Claim 54 (Original): The system of claim 53, wherein the database is located remote from the computing device and coupled to the computing device via a network.

Claim 55 (Original): The system of claim 53, wherein the attributes comprise one or more of dimensions, slot locations, torque angles, and angulations for the types of orthodontic appliances.

Claim 56 (Previously Presented): The system of claim 40, further comprising:

a database that stores planar guide data that specifies a plurality of types of planar guides,

wherein the user interface receives input from the practitioner enabling the display of at least one or more of the types of planar guides, and the guide control module controls the planar guide within the 3D environment in accordance with the selected one or more types of planar guides.

Claim 57 (Original): The system of claim 40, further comprising:

a database that stores planar guide data that describes attributes for different types of planar guides, and

wherein the guide control module controls the planar guide within the 3D environment in accordance with the stored attributes for the different types of planar guides.

Claim 58 (Original): The system of claim 57, wherein the database stores attributes for the different types of planar guides with respect to different types of orthodontic appliances.

Claim 59 (Original): The system of claim 57, wherein the database stores attributes for the different types of planar guides with respect to different types of teeth within the dental arch.

Claim 60 (Previously Presented): The system of claim 57, wherein the database stores attributes that specify distances for each of the different types of planar guides with respect to at least one of the tooth of the dental arch, a different one of the planar guides, and the orthodontic appliance.

Claim 61 (Original): The system of claim 57, wherein the database stores attributes that specify shear angles and scales for the different types of planar guides.

Claim 62 (Previously Presented): The system of claim 40, wherein the guide control module automatically scales the planar guide within the 3D environment to size the planar guide based on one or more dimensions of the tooth within the dental arch.

Claim 63 (Original): The system of claim 40, wherein the guide control module automatically shears the planar guide in accordance with a shear factor that is based on an angulation associated with the orthodontic appliance.

Claim 64 (Previously Presented): The system of claim 40, the orthodontic appliance defines a mesial edge and a distal edge, and wherein the guide control module automatically shears the planar guide in accordance with an angle of the orthodontic appliance to align the planar guide with at least one of the mesial edge or the distal edge of the orthodontic appliance.

Claim 65 (Previously Presented): The system of claim 40, further comprising

a database that stores data defining one or more placement rules for placing the orthodontic appliance, and

wherein the guide control module controls the planar guide within the 3D environment in accordance with the placement rules.

Claim 66 (Original): The system of claim 65, wherein the guide control module automatically renders the planar guide within the 3D environment as parallel to a midsagittal plane of the orthodontic appliance in response to one of the placement rules that requires a longitudinal axis or an occlusal-gingival axis of the orthodontic appliance be aligned with the midsagittal plane of the tooth.

Claim 67 (Original): The system of claim 40, further comprising:

a database that stores statistical normal distances for one or more dimensions of teeth, and

wherein the guide control module controls the location of the planar guide within the 3D environment based on the statistical normal distances.

Claim 68 (Original): The system of claim 40, wherein the user interface receives input biasing the planar guide relative to the statistical normal distance, and the guide control module adjusts the location for the planar guide based on the input.

Claim 69 (Original): The system of claim 39, wherein the user interface displays visual reference markers relative to the planar guide at discrete intervals.

Claim 70 (Original): The system of claim 69, wherein the user interface displays the visual reference markers as a rectilinear grid of semi-transparent lines on the planar guide.

Claim 71 (Original): The system of claim 69, wherein the user interface displays the visual reference markers as points, crosshairs, tic marks, discs, squares, or spheres at the discrete intervals.

Claim 72 (Original): The system of claim 69, wherein the user interface displays the visual reference markers throughout a volume bounded by the planar guide and at least one other planar guide.

Claim 73 (Previously Presented): The system of claim 39, wherein the user interface displays contour lines on the planar guide, wherein each contour line indicates a constant distance to a surface of the tooth within the 3D environment relative to the planar guide.

Claim 74 (Original): The system of claim 39, wherein the orthodontic appliance comprises an orthodontic bracket, a buccal tube, a sheath, a button or an arch wire.

Claim 75 (Previously Presented): A non-transitory computer-readable medium comprising instructions for causing a programmable processor to:

render a three-dimensional (3D) digital representation of a tooth within the 3D environment; and

while displaying the digital representation of the tooth, display a two-dimensional planar guide within the 3D environment as a visual aid to a practitioner in a placement of an orthodontic appliance relative to the tooth within the 3D environment, wherein the planar guide is displayed separately from the digital representation of the tooth, and wherein the instructions cause the programmable processor to display the planar guide by rendering the planar guide at a location based on a position of the orthodontic appliance within the 3D environment as the practitioner moves the orthodontic appliance relative to the tooth within the 3D environment.

Claim 76 (Previously Presented): The non-transitory computer-readable medium of claim 75, wherein the instructions cause the processor to:

associate a coordinate system with the orthodontic appliance within the 3D environment, and

generate the planar guide within the 3D environment relative to the coordinate system associated with the orthodontic appliance.

Claim 77 (Previously Presented): The non-transitory computer-readable medium of claim 75, wherein the instructions cause the processor to receive input from the practitioner via the user interface, the input comprising an adjustment to the placement of the orthodontic appliance with respect to the tooth within the 3D environment, and automatically move the planar guide within the 3D environment as the practitioner adjusts the placement of the orthodontic appliance with respect to the tooth within the 3D environment.

Claim 78 (Previously Presented): The non-transitory computer-readable medium of claim 75, wherein the instructions cause the processor to display the planar guide as one of:

a mesial planar guide or a distal planar guide parallel to and optionally equidistant from a midsagittal plane of the orthodontic, wherein the orthodontic appliance defines a mesial edge, a distal edge, and a longitudinal axis and the midsagittal plane is substantially parallel to the longitudinal axis, and wherein the mesial planar guide aligns with the mesial edge of the orthodontic appliance and the distal planar guide aligns with the distal edge of the orthodontic appliance,

an occlusal planar guide parallel to a midlateral plane of the orthodontic appliance and proximate an occlusal surface of the tooth,

a gingival planar guide parallel to a gingival edge of the orthodontic appliance,

a midlateral planar guide parallel to a midlateral plane of the orthodontic appliance,

a midfrontal planar guide parallel to a midfrontal plane of the orthodontic appliance, and

a midsagittal planar guide parallel to the midsagittal plane of the orthodontic appliance.

Claim 79 (Previously Presented): The non-transitory computer-readable medium of claim 75, wherein the instructions cause the processor to:

store data defining one or more placement rules for placing the orthodontic appliance; and

control the planar guide to assist the practitioner in positioning the orthodontic appliance in accordance with the placement rules.

Claim 80 (Previously Presented): The method of claim 1, further comprising computing a planar guide orientation of the planar guide based on the placement of the orthodontic appliance within the 3D environment relative to the dental arch.

Claim 81 (Previously Presented): The system of claim 39, wherein the guide control module further computes a planar guide orientation of the planar guide based on the placement of the orthodontic appliance within the 3D environment relative to the dental arch.

Claim 82 (Previously Presented): The non-transitory computer-readable medium of claim 75, wherein the instructions cause the processor to compute a planar guide orientation of the planar guide based on the placement of the orthodontic appliance within the 3D environment relative to the dental arch.

Claim 83 (Previously Presented): The method of claim 1, wherein the planar guide comprises a first planar guide, the method further comprising:

while displaying the digital representation of the tooth of the dental arch and the first planar guide, displaying, via the user interface of the computing device, a second two-dimensional planar guide within the 3D environment, wherein the first and second planar guides lie in different planes.

Claim 84 (Previously Presented): The method of claim 83, further comprising automatically moving the first planar guide and the second planar guide within the 3D environment as the practitioner moves the orthodontic appliance with respect to the tooth within the 3D environment.

Claim 85 (Previously Presented): The method of claim 1, wherein the planar guide comprises an occlusal planar guide, and displaying a planar guide further comprises rendering the occlusal planar guide to penetrate an occlusal surface of the digital representation of the tooth.

Claim 86 (Previously Presented): The method of claim 1, wherein the planar guide comprises a distal planar guide, and displaying a planar guide further comprises rendering the distal planar guide to penetrate a distal edge of the digital representation of the tooth.

Claim 87 (Previously Presented): The method of claim 1, wherein displaying the two-dimensional planar guide comprises displaying at least one two-dimensional planar guide that does not contact the orthodontic appliance within the 3D environment.

Claim 88 (Previously Presented): The method of claim 1, further comprising:

receiving user input adjusting a distance between the planar guide and the orthodontic appliance, wherein displaying the planar guide within the 3D environment comprises displaying the planar guide at the distance from the orthodontic appliance within the 3D environment.

Claim 89 (New): The method of claim 1, wherein the planar guide comprises a first planar guide and the location comprises a first location, the method further comprising, while displaying the digital representation of the tooth of the dental arch, displaying, via the user interface of the computing device, a second two-dimensional planar guide within the 3D environment, wherein displaying the second planar guide comprises, as the practitioner moves the orthodontic appliance relative to the tooth within the 3D environment, rendering the second planar guide at a second location that is based on at least one of the position or the orientation of the orthodontic appliance within the 3D environment, wherein a distance between the first and second planar guides within the 3D environment is adjustable.